# PATENT ABSTRACTS OF JAPAN

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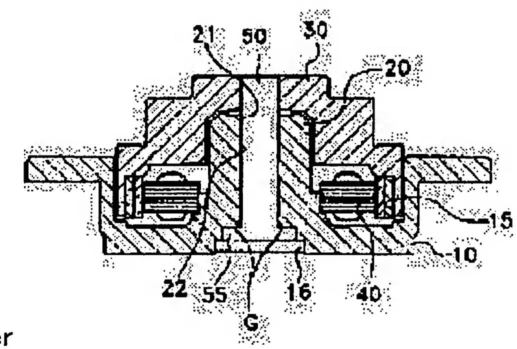
## (54) HYDRODYNAMIC PRESSURE BEARING MOTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To prolong the life of use and to enhance the reliability on perfor mance by not only enhancing assemblability, workability, and productivity in manufacturing, but also enhancing structural rigidity and durability, and improving the NRRO and PRO properties of a motor.
SOLUTION: This bearing motor is composed of housing provided with a sleeve which has a shaft hole penetrated vertically, is in the center and in a pipe shape, is integrated and projects upwards, a core to be connected to the peripheral surface of the sleeve, a shaft which is inserted vertically into the shaft hole of the sleeve rotatably and has a thrust which is in a board material shape in the lower end part and is integrated with each other, a hub with magnets which generate electromagnetic force by their material action with the core and are attached to the internal peripheral surface of the end part of an extended end connected to the upper part of the shaft into an integrated body and extended downwards, and a cover plate for tightly closing the lower end of the shaft hole of the sleeve into which a shaft is inserted.

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CLAIMS

[Claim 1] Housing with which the upward protrusion of the sleeve in which the boss penetrated perpendicularly was formed was carried out in the tubing configuration in the center section at one, The core combined with the peripheral face of said sleeve, and the shaft by which it was perpendicularly inserted in the boss of said sleeve pivotable, and the thrust of a plate mold was formed in the lower limit section at one, The hub where the trailer inner skin of the extended edge which was combined with the upper limit section of said shaft by one, and extended caudad adhered to the magnet which generates electromagnetic force by the interaction with a core, The fluid dynamic pressure bearing motor characterized by consisting of a cover plate which makes the boss lower limit section of the sleeve in which said shaft was inserted seal.

[Claim 2] Said sleeve is a fluid dynamic pressure bearing motor according to claim 1 characterized by being fabricated with the ceramic alloy aluminum quality of the material.

[Claim 3] Housing with which the boss which the periphery edge extended upward and penetrated at right angles to a center was formed, The hub where the sleeve in which the boss penetrated perpendicularly was formed is projected downward by one in a tubing configuration in the center section, a periphery edge extends below, and it adheres to a magnet in the bore side of an extended edge, The core which it is combined [ core ] with the peripheral face of the lobe projected around the boss of said housing, generates electromagnetic force by the interaction with the magnet which countered, and rotates a hub focusing on a shaft, The shaft which it is perpendicular to the boss of said sleeve, and is inserted, the thrust of a plate mold is formed in the upper limit section at one,

and the lower limit section is combined with the boss of housing, and is fixed, The fluid dynamic pressure bearing motor characterized by consisting of a cover plate which makes the boss upper limit section of the sleeve in which said shaft was inserted seal.

[Claim 4] Said sleeve is a fluid dynamic pressure bearing motor according to claim 3 characterized by being fabricated with the ceramic alloy aluminum quality of the material.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the fluid dynamic pressure bearing motor which assembly precision can be raised and can improve an irregularity-oscillation characteristic in more detail about the motor carried in a small precision mechanical equipment.

[0002]

[Description of the Prior Art] Generally, the property that high-speed driving force not only being required but precision control must be possible for the motor used for a precision mechanical equipment like a hard disk driver is required.

[0003] For example, the recording density of the hard disk which is a storage medium is also increasing rapidly too with fast elongation of a personal computer. Moreover, although the rotational speed of a motor is made to accelerate to 10000 or more revolutions from per minute 7200 or less revolution also in order to raise a data-access rate, on the other hand, the actual condition is that the demand of safety and silence is also increasing to coincidence.

[0004] In order to satisfy such a property, the engine performance of a ball bearing has reached the limitation, and in order to solve this, recently, it is in the trend which adopts the fluid dynamic pressure bearing which vibration and whose noise were small instead of the conventional metal bearing or a ball bearing as a means to support a shaft, and was excellent in shock resistance.

[0005] Thus, a fluid dynamic pressure bearing motor is large, it is divided roughly into an axial rotation mold and an axial cover half by the rotation propriety of a shaft, and oil is usually used as a means to support so that body of revolution can rotate these motors smoothly at high speed.

[0006] Said oil is filled up with the periphery edge of a shaft and this shaft between wrap sleeves, and he makes the frictional force by direct contact minimize, and is trying to always locate a shaft at the core of a sleeve between these shafts and a sleeve on the other hand.

[0007] Drawing 1 and 2 have the rotation member which consists of housing 100, a holddown member which consists of a sleeve 110 and a core 120, and a shaft 130, a hub 140 and a magnet 150 as a configuration means to make a motor, as it is what showed the axial rotation mold motor which a shaft rotates and was illustrated at the conventional fluid dynamic pressure bearing.

[0008] It is constituted so that a center section may penetrate perpendicularly and a shaft 130 may be inserted pivotable, and the slot 111 for dynamic pressure generating is formed in a bore side, and a sleeve 110 generates the radial fluid dynamic pressure of a shaft 130.

[0009] Especially the bore section of said sleeve 110 is constituted so that the thrust 160 of the shape of anular shape of a disk may be combined with the lower limit section of a shaft 130 pivotable with a shaft 130, and as for the

outer-diameter section, fixed wearing of the core 120 with which the coil was wound around the periphery edge is carried out.

[0010] By forming the slot 161 for dynamic pressure generating in a top face and an inferior surface of tongue, said thrust 160 is constituted here so that the fluid dynamic pressure to shaft orientations may occur.

[0011] On the other hand, the bore section is covered with a cover plate 170, the lower limit section of said sleeve 110 is intercepted with the exterior, and relative contact of the thrust 160 is carried out pivotable with this cover-plate 170 up side.

[0012] And a hub 140 is combined with the upper limit of the shaft 130 inserted in the bore section of said sleeve 110 rotatable by one, and the outer-diameter side of a core 120 and the magnet 150 which counters are magnetized by the bore side of an extended edge in the cap configuration in which this hub 140 was opened wide caudad.

[0013] Between the bore side of a sleeve 110, a shaft 130, and a thrust 160, the oil gap G is formed minutely, and the oil which has predetermined viscosity is filled with such structure by this oil gap G.

[0014] Concentrating on the slot 111 for dynamic pressure generating with a sleeve 110, and the slot 161 for dynamic pressure generating of a thrust 160 at the time of rotation of a shaft 130, the oil gap G is always maintained by homogeneity, a shaft 130 is stabilized in this way by the oil in such an oil gap G, and it enables it to drive it.

[0015] If the power source from the outside is transmitted to a core 120, the hub 140 where it adhered to the magnet 150 according to the mutual electromagnetic force between said cores 120 and magnets 150 will rotate, and the shaft 130

combined with the hub 140 will come to rotate to coincidence the conventional axial rotation mold fluid dynamic pressure bearing motor which has the above configurations.

[0016] The shaft 130 made to insert in the bore section of a sleeve 110 can rotate the bore side of a sleeve 110 now smoothly in the state of non-contact with the fluid dynamic pressure generated between the slots 111 for dynamic pressure generating formed in the bore side of a sleeve 110, and the outer-diameter side of a shaft 130 at the time of the drive of such a motor.

[0017] That is, high-speed rotation is made to be carried out smoothly, a rotation load being made [ between the outer-diameter side of a shaft 130, and the bore side of a sleeve 110, a proper quantity of oil is already supplied, at the time of rotation of a shaft 130, while oil flows according to the slot 111 for dynamic pressure generating formed in the bore side of a sleeve 110, come to generate dynamic pressure, and ] minimization by this.

[0018] Drawing 3 and 4 are the conventional fluid dynamic pressure bearings, they are what showed the axial cover-half motor by which the shaft was fixed, and as illustrated, they have the rotation member which becomes a configuration means to make a motor from a core 120 and the holddown member and sleeve 110 which consist of a shaft 130, a hub 140, and a magnet 150. [ housing 100, ]

[0019] Such an axial cover-half fluid dynamic pressure bearing motor consists of requirements for a configuration almost similar to the axial rotation mold fluid dynamic pressure bearing motor mentioned above, and it merely fills up with the oil which has predetermined viscosity about the oil gap G by which the sleeve 110 and the hub 140 were formed between the bore section of a sleeve 110, and a shaft 130 at one in the joint rotation structure centering on the shaft 130 fixed to

housing 100.

[0020] Said especially sleeve 110 is combined so that the thrust 160 of the shape of anular shape of a disk can really rotate with a shaft 130 in the upper limit section of a shaft 130, and as for said shaft 130, axial immobilization of the lower limit section is carried out in the center section of housing 100 at one.

[0021] Here, it turns up the predetermined height protrusion of the edge of the through hole in which the shaft 130 was inserted, and, as for said housing 100, fixed wearing of the core 120 with which the coil was wound around the periphery edge of this projected extended edge is carried out.

[0022] Here, the fluid dynamic pressure to shaft orientations comes to generate said thrust 160 like [ in the axial rotation mold motor mentioned above ] by forming the slot 161 for dynamic pressure generating in a vertical side.

[0023] On the other hand, electric shielding cutoff of the bore section is carried out with a cover plate 170, and, as for the upper limit section of said sleeve 110, relative contact of the thrust 160 is carried out pivotable at this cover-plate 170 bottom.

[0024] And it is strongly combined with the up peripheral face of said sleeve 110 so that a hub 140 can really rotate, and the magnet 150 is magnetized so that the inner skin of this hub 140 may be countered with the outer-diameter side of a core 120.

[0025] Between the bore side of a sleeve 110, a shaft 130, and a thrust 160, the oil gap G is formed like the axial rotation mold motor mentioned above, and oil is filled with such structure by this oil gap G.

[0026] Between this core 120 and magnet 150, predetermined electromagnetic force will come to occur mutually, the hub 140 where it adhered to the magnet

150 will rotate, and the conventional axial cover-half fluid dynamic pressure bearing motor which has the above configurations will come to rotate focusing on the shaft 130 with which the sleeve 110 combined now with the hub 140 was housing 100 and really combined, if a power source is impressed to a core 120.

[0027] Therefore, a sleeve 110 rotates said axial cover-half motor in the non-contact condition mutually with the fluid dynamic pressure generated between the slots 131 for dynamic pressure generating formed in the outer-diameter side of a shaft 130.

[0028]

[Problem(s) to be Solved by the Invention] However, the conventional axial rotation mold or the axial cover-half fluid dynamic pressure bearing motor constituted as mentioned above had the problem as which an oscillation characteristic is determined with the assembly precision of a sleeve 110.

[0029] That is, in order that the conventional fluid dynamic pressure bearing motor may pass through the press fit process which makes a sleeve 110 press fit in housing 100, the configuration of a sleeve 110 is deformed by the pressure applied from a housing 100 side, and roundness becomes a defect with it.

[0030] Drawing 5 and drawing 6 are the graphics which measured the roundness and straightness of a sleeve by the fluid dynamic pressure bearing motor concerning the conventional technique shown in drawing 1 .

[0031] A difference occurs in the vertical bore section of a sleeve 110, of course, the configuration of the slot 111 for dynamic pressure generating becomes an ununiformity, and it turns out that 3.5 micrometers to which the depth of average measurement does not result in the design value of 4 micrometers are measured as it illustrated when the roundness of the sleeve 110 shown in drawing 5 was

seen, and the depth of the design value of the slot 111 for dynamic pressure generating was set to 4 micrometers.

[0032] On the other hand, when the straightness of the sleeve 110 shown in drawing 6 is seen, it turns out that the inside deforms severely the bottom bore section of the sleeve 110 to which housing 100 or the assembly force of a hub 140 is applied directly compared with the top bore section, and about 2-micrometer bore difference occurs.

[0033] That is, although housing 100 is made to press a sleeve 110 fit in the case of an axial rotation mold motor and it comes to press a sleeve 110 fit in an axial cover-half motor as mentioned above in a hub 140, deflection with the bore side of a sleeve 110 considerable in respect of roundness or a straightness occurs by dispersion or assembly dispersion of a dimension between each part articles.

[0034] Therefore, since the oscillation characteristic of a motor is determined according to the assembly precision of said sleeve 110, i.e., coaxiality, there is demerit separated on the side face of dispersion management.

[0035] Moreover, since it is the assembly between components, in order to have to process it in consideration of bonding strength, a limitation is in improvement in precision, the coaxiality of a sleeve 110 comes to collapse by the gap especially produced in the assembly tolerance between components, and there is a problem to which NRRO (Non-RepeatableRun Out) and RRO (Repeatable Run Out) become large.

[0036] That is, at fluid dynamic pressure bearing, if body of revolution inclines toward an one direction and a gap (clearance) becomes narrow, along with it, a pressure will occur greatly and will come to return body of revolution to a original location, but if the precision (coaxiality) from which it separates becomes large,

change of dynamic pressure will become intense and an oscillation characteristic like NRRO and RRO will become large.

[0037] There is a problem that a very difficult activity is required [ in / by processing of itself being not only difficult for a thrust 160 in this way but assembly / management of squareness with a shaft 130 ] although a right angle must be made not only in a precision level considerable in order to process the bore of a thrust 160, since assembly of the thrust 160 is carried out to a shaft 130 on the other hand by press fit between heat being required but in the shaft 130.

[0038] While the metal of an SUS network be use especially for said thrust 160 and shaft 130 , since brass ( blister copper ) and bronze ( bronze ) with a larger coefficient of thermal expansion than it be use as the quality of the material , according to the difference of the coefficient of thermal expansion between both the quality of the materials , at an elevated temperature , the oil gap G spread too much , a sleeve 110 come to show the property that change be remarkable , and they have the problem that the drive of a motor become unstable .

[0039] therefore -- above -- the assembly precision between a sleeve 110, housing 100 or a sleeve 110, and a hub 140 -- vibration -- generating -- such vibration -- **** -- not only the engine performance of a motor falls, but the dependability over a product causes the problem spoiled greatly.

[0040] This invention is made in view of the above-mentioned trouble. The main purpose is in offering the fluid dynamic pressure bearing motor manufactures a sleeve in housing by the axial rotation mold motor at one, and manufactures a sleeve to a hub by the axial cover-half motor at one, make minimize the oscillation characteristic by assembly tolerance, and it enables it to raise easy manufacture nature and productivity.

[0041] Moreover, other purposes of this invention are manufactured with silicon aluminum with the coefficient of thermal expansion which resembled SUS in the quality of the material of a sleeve, and are by processing housing and a sleeve into one apparatus to reduce the RRO property of the reduction of rigidity and a motor accompanying a temperature rise.

[0042]

[Means for Solving the Problem] Housing with which the upward protrusion of the sleeve in which the boss which penetrated perpendicularly the 1st invention which solves the above-mentioned technical problem was formed was carried out in the tubing configuration in the center section at one, The core combined with the peripheral face of said sleeve, and the shaft by which it was perpendicularly inserted in the boss of said sleeve pivotable, and the thrust of a plate mold was formed in the lower limit section at one, The hub where the trailer inner skin of the extended edge which was combined with the upper limit section of said shaft by one, and extended caudad adhered to the magnet which generates electromagnetic force by the interaction with a core, It is characterized by consisting of a cover plate which makes the boss lower limit section of the sleeve in which said shaft was inserted seal.

[0043] Said sleeve in the 1st invention is characterized by being fabricated with the ceramic alloy aluminum quality of the material.

[0044] Moreover, housing with which the boss which the periphery edge extended upward and penetrated the 2nd invention which solves the above-mentioned technical problem at right angles to a center was formed, The hub where the sleeve in which the boss penetrated perpendicularly was formed is projected downward by one in a tubing configuration in the center section, a periphery edge

extends below, and it adheres to a magnet in the bore side of an extended edge, The core which generates electromagnetic force and rotates a hub focusing on a shaft by the interaction with the magnet which was combined with the peripheral face of the lobe projected around the boss of said housing, and countered, It is perpendicular to the boss of said sleeve, it is inserted, the thrust of a plate mold is formed in the upper limit section at one, and it is characterized by the lower limit section consisting of a shaft which is combined and is fixed to the boss of housing, and a cover plate which makes the boss upper limit section of the sleeve in which said shaft was inserted seal.

[0045] Said sleeve in the 2nd invention is characterized by being fabricated with the ceramic alloy aluminum quality of the material.

[0046]

[Embodiment of the Invention] Drawing 7 and drawing 8 are the drawings in which the axial rotation mold fluid dynamic pressure bearing motor concerning this invention was shown. A motor is divided roughly into the rotation member rotated by the interaction with said holddown member by the holddown member which maintains a fixed condition, and current supply as illustrated.

[0047] A holddown member consists of a sleeve 20, housing 10, and a core 40 greatly, and the rotation member consists of a shaft 50, a hub 30, and a magnet 15.

[0048] The shaft 50 the boss 21 to which the center section penetrated the sleeve 20 perpendicularly is formed, and is [ shaft ] a rotation member at this boss 21 is inserted pivotable.

[0049] Such a sleeve 20 usually comes to form the radial fluid dynamic pressure of a shaft 50 by the slot 22 for dynamic pressure generating being formed in the

bore side of a boss 21.

[0050] On the other hand, predetermined spacing is set mutually, it is isolated and said sleeve 20 and shaft 50 come to form the oil gap G. The oil for making this oil gap G control mutual friction of a sleeve 20 and a shaft 50 comes to be filled.

[0051] Such oil comes to form fixed fluid pressure at the time of rotation of a shaft 50, flowing to the hand of cut of a shaft 50, and a shaft 50 comes to have the property which is going to move to radial and shaft orientations of a shaft under the effect of such fluid pressure.

[0052] Therefore, the radial powerful fluid dynamic pressure of a shaft is formed about the oil gap G so that the slot for dynamic pressure generating may be formed in at least 1 side face of the outer-diameter side of a shaft 50, or the bore side of the sleeve 20 which counters it, and in the former, the oil gap G between a sleeve 20 and a shaft 50 is made to be maintained with the fluid dynamic pressure at this time by homogeneity.

[0053] Although the slot 22 for dynamic pressure generating formed as a means for generating the radial fluid dynamic pressure of such a shaft is formed in the peripheral face of a shaft 50, usually If the slot for dynamic pressure generating is formed in the shaft 50 which is the member to rotate, in order for a rotation load to act friction with a shaft 50 and oil becoming intense, in current It is common that the slot 22 for dynamic pressure generating which generates the radial fluid dynamic pressure of a shaft is formed in the bore side of the sleeve 20 which is a non-driving member.

[0054] On the other hand, the core 40 around which, as for the outer-diameter section of said sleeve 20, the coil with which a power source is impressed to the

periphery edge was wound comes to generate predetermined electromagnetic force by the interaction by fixed wearing being carried out and opposite arrangement of this core 40 being carried out with the magnet 15 to which the inner skin of the hub 30 mentioned later adhered.

[0055] Moreover, adhesives etc. adhere to the cover plate 16 of a plate mold, it comes to make the lower limit section of said sleeve 20 intercept from the outside the lower limit section of the boss 21 penetrated perpendicularly, and relative contact of the shaft 50 which possesses a thrust 55 to this cover-plate 16 up side is carried out pivotable.

[0056] Here, in the case of an axial rotation mold, the lower limit section of a shaft 50 is equipped with said thrust 55 as a means for generating the fluid dynamic pressure to shaft orientations with the radial fluid dynamic pressure of the shaft generated by the slot 22 for dynamic pressure generating formed in the sleeve 20.

[0057] And the magnet 15 to which the hub 30 of a cap configuration which adhered the magnet 15 to the inner skin of the extended edge which extended outside termination caudad, and which was opened wide caudad was combined with the upper limit section of said shaft 50, and it adhered in this hub 30 is arranged so that it may counter with the outer-diameter side of a core 40.

[0058] If a power source is impressed from the exterior, a hub 30 will rotate and drive such an axial rotation mold fluid dynamic pressure bearing motor of a configuration with a shaft 50 according to the electromagnetic force generated by the interaction between a core 40 and a magnet 15.

[0059] Although the above configurations are the same as that of the structure of the conventional axial rotation mold fluid dynamic pressure bearing motor

almost, this invention merely has the description most remarkable in a thrust 55 being formed in a shaft 50 at one, said sleeve 20 and housing 10 being formed in one.

[0060] That is, the boss which said housing 10 was perpendicular to the center as the sleeve 20 projected upward in the tubing configuration was formed in the center section of the cutting process by turning etc. at one and this sleeve 20 was mentioned above, and was penetrated is formed.

[0061] A periphery edge is extended upward and, as for such housing 10, a part of lower limit of a hub 30 is received by the inner circumference edge of this extended extended edge. And the shaft 50 combined so that it might rotate to a hub 30 and one is perpendicularly inserted in the boss 21 of the sleeve 20 projected and formed upward in the center section pivotable.

[0062] The thrust 55 to which the shaft 50 inserted on the other hand at right angles to the boss of the sleeve 20 formed in said housing 10 by one becomes the lower limit section from a circular monotonous member is formed in one, and relative contact of this shaft 50 and thrust 55 is carried out pivotable to the top side of a cover plate 16.

[0063] A shaft 50 comes to prevent rising to surface in the upper part at the time of rotation, and, as for such a thrust 55, the fluid dynamic pressure to shaft orientations is made to be generated between the up side of a thrust 55, the bore side where the level difference of a sleeve 20 was attached and the lower side of a thrust 55, and the up side of the cover plate 16 with which the lower limit section of a boss 21 is covered outside.

[0064] While forming the slot for dynamic pressure generating (not shown) in the bore side of a horizontal where the level difference was attached between the up

side shaft hole 21 of the sleeve 20 which counters the up side of said thrust 55 here, and the lower side shaft hole 21 which has a larger bore than it It is desirable to form the slot for dynamic pressure generating (not shown) formed in the bore side of a sleeve 20 also in the up side of the cover plate 16 combined in order to make a boss 21 cover from the outside in the lower limit section of a sleeve 20.

[0065] On the other hand, this invention can be carried out also by the axial cover-half fluid dynamic pressure bearing motor, and this is as having illustrated to drawing 9 and drawing 10 .

[0066] As illustrated, an axial cover-half fluid dynamic pressure bearing motor can carry out a thrust 55 also in the structure formed in a shaft 50 at one, making the sleeve 20 and hub 30 which are a rotation member form in one.

[0067] That is, an axial cover-half fluid dynamic pressure bearing motor is divided roughly into the holddown member which consists of housing 10, a core 40, and a shaft 50, and the rotation member which consists of a sleeve 20, a hub 30, and a magnet 15.

[0068] The lower limit of a shaft 50 is fixed to housing 10, and, as for such an axial cover-half fluid dynamic pressure bearing motor, the oil gap G with which oil is filled up is formed between the bore section of a sleeve 20, and the outer-diameter section of a shaft 50 with the structure which it is combined with one and a sleeve 20 and a hub 30 rotate focusing on this shaft 50.

[0069] And the upper limit section of the boss 21 which the upper limit section adhered to the sleeve 20 in which the boss 21 in which is equipped with the thrust 55 which the bore section of said sleeve 20 has a bore with the larger upper part compared with the lower part, and consists of a monotonous member

circular in the upper limit section of a shaft 50, and said shaft 50 is inserted was formed to the cover plate 16 of a plate mold with adhesives etc., and was penetrated perpendicularly is made to intercept from the outside.

[0070] Here, said thrust 55 omits explanation, in order to do so the same operation as the axial rotation mold thrust 55 mentioned above. Although such a configuration is the same as that of the structure of the conventional axial cover-half fluid dynamic pressure bearing motor almost, this invention merely has the description in a thrust 55 really being formed in a shaft 50, the sleeve 20 and hub 30 which are a rotation member really being formed.

[0071] That is, the boss 21 which the sleeve 20 caudad projected in the tubing configuration in the center section was formed at one, and said hub 30 had it as [ this sleeve 20 ] usual, and was penetrated is formed. [ perpendicular to the center ]

[0072] It adheres to a magnet 15 in the bore side of the extended edge which extended caudad, and this magnet 15 generates electromagnetic force by the core 40 and interaction which were combined with the peripheral face of the lobe formed in housing 10, and such a hub 30 comes to rotate a hub 30 focusing on a shaft 50.

[0073] The thrust 55 to which the shaft 50 inserted on the other hand at right angles to the boss 21 of the sleeve 20 formed in said hub 30 by one becomes the upper limit section from a circular monotonous member is formed in one.

[0074] He comes to prevent such a thrust 55 and is trying for fluid dynamic pressure to generate it in shaft orientations between the lower sides of the cover plate 16 with which a shaft 50 covers from the outside the bore side where the up side of a thrust 55 and the level difference of a sleeve 20 were attached [ moving

to the lower part, and ], and the boss upper limit section of a sleeve 20 at the time of rotation.

[0075] between the boss 21 by the side of the lower part of the sleeve 20 which counters the lower side of said thrust 55 here, and the bosses 21 by the side of the upper part which has a larger bore than it -- ******** with a level difference, while forming the slot for dynamic pressure generating (not shown) in the bore side of the horizontal made like It is desirable to make the slot for dynamic pressure generating (not shown) formed in the bore side of a sleeve 20 form also in the lower side of the cover plate 16 combined in order to make a boss 21 cover from the outside in the upper limit section of a sleeve 20.

[0076] Although the metal of the stainless steel quality of the material is used for the axial rotation mold and the axial cover-half fluid dynamic pressure bearing motor which are constituted as mentioned above on the other hand by a shaft 50 and the cover plate 16 as usual, a sleeve 20 has a coefficient of thermal expansion lower than a shaft 50 and a cover plate 16, or it is more desirable to make it fabricate with the ceramic alloy aluminum quality of the material which is the same quality of the material. That is, Mn can make reinforcement able to increase among the component of ceramic alloy aluminum, and Mg, and Si and Cu can increase corrosion resistance and tough nature.

[0077] Therefore, said ceramic alloy aluminum is not only excellent in the corrosion resistance which can be equal to the corrosion by oil compared with general aluminum, but is equipped with the property excellent in a degree of hardness and reinforcement. As mentioned above, when the ceramic alloy aluminum quality of the material is made to fabricate a sleeve 20 from the conventional bronze quality of the material and property change of RRO is seen

with the temperature of a motor, it is as being shown in the next table.

[0078]

[Table 1]

[0079] As mentioned above, it turns out that change of RRO of the sleeve motor fabricated with the ceramic alloy aluminum quality of the material compared with the sleeve motor fabricated with the bronze quality of the material is small.

[0080] On the other hand, drawing 11 and 12 are the graphs which measured the roundness and straightness of a fluid dynamic pressure bearing motor in drawing 7 .

[0081] First, when the roundness of the sleeve 20 shown in drawing 11 was seen and the depth of the design value of the slot 22 for dynamic pressure generating is set to 4 micrometers, since this invention becomes unnecessary to pass like an erector like the conventional press fit process, it turns out that the configuration of the slot 22 for dynamic pressure generating has the depth uniform on the whole and fixed.

[0082] Moreover, in order not to pass like an erector like the conventional press fit process as mentioned above if the straightness of the sleeve 20 shown in drawing 12 is seen, it turns out that there is no difference of the bore of the upper bottom.

[0083] Drawing 13 and 14 are the graphs which measured the load-carrying capacity of the motor which fabricated the quality of the material with ceramic alloy aluminum (ASCM), and the motor which pressed fit in housing 10 or a hub 30 the sleeve 20 which fabricated with conventional brass or the conventional

bronze quality of the material, forming a sleeve 20 in one.

[0084] Here, load-carrying capacity (Load Capacity) does not say the magnitude of the external load which can support the dynamic pressure generated at bearing, and when the load-carrying capacity of bearing is smaller than an actual load, it becomes impossible to generate sufficient dynamic pressure, and it becomes the direct cause of the degradation of bearing.

[0085] That is, drawing 13 shows the load-carrying capacity of X shaft orientations, and drawing 14 shows the load-carrying capacity to Y shaft orientations. As illustrated, the sleeve 20 fabricated with the ceramic alloy aluminum concerning this invention shows that the load characteristic stabilized also at the time of a temperature rise is maintained. In contrast, as for the sleeve 20 fabricated with brass or the bronze quality of the material, it turns out that the property becomes unstable in proportion to the increment in temperature.

[0086] On the other hand, drawing 15 and 16 are the graphs which compared the rigidity (stiffness) concerning this invention and the conventional technique, drawing 15 shows the rigidity of X shaft orientations, and drawing 16 shows the rigidity of Y shaft orientations.

[0087] Here, the ratio of the force which rigidity is the key factor child who affects the resonant frequency of a motor, and was usually applied to the shaft, and the variation rate of a shaft is referred to as being the rigidity of the bearing.

[0088] the sleeve 20 fabricated with brass or the bronze quality of the material although rigidity increased the motor which requires the sleeve 20 fabricated with ceramic alloy aluminum (ASCM) for this invention adopted as one in proportion to the temperature rise as illustrated -- assembly **** -- as for a common motor, it turns out that rigidity falls greatly relatively.

[0089] Drawing 17 and 18 are the graphs which compared the damping (damping) concerning this invention and the conventional technique. Drawing 17 shows damping of X shaft orientations. Drawing 18 shows damping of Y shaft orientations.

[0090] Here, when the external force from what kind of the outside or an impact is added, damping is attenuating this and relates to the shock resistance of bearing.

[0091] the sleeve 20 by which the damping force was increased, or the motor concerning this invention adopted as one was contrary to the property stabilized in proportion to the temperature rise being shown, and the sleeve 20 fabricated with ceramic alloy aluminum (ASCM) was fabricated with brass or the bronze quality of the material as illustrated -- assembly **** -- as for a common motor, it turns out that the damping force declines greatly in proportion to a temperature rise.

[0092] Thus, this invention making a sleeve 20 and housing 10 form by one with an axial rotation mold A thrust 55 by coming to manufacture at a shaft 50 at one, making a thrust 55 form in a shaft 50 by one, and making a sleeve 20 and a hub 30 form in one by the axial cover half The squareness between each part articles can follow on improving, manufacture can become easy, and the abrasion resistance of a motor can be raised by structural rigid increase.

[0093] Moreover, if it is lower than a shaft 50 and a cover plate 16 in a sleeve 20 or comes to constitute from the ceramic alloy aluminum quality of the material which has the same coefficient of thermal expansion as mentioned above Since it can avoid spreading the oil gap G between the sleeve 20 in early stages of [ minimum at an elevated temperature ] a drive, and a shaft 50 more than this at

the time of the high-speed drive of a motor, The property rate of change in an elevated temperature can be decreased, and the property of NRRO (Non-Repeatable Run Out) in a motor and RRO (Repeatable Run Out) can be raised especially.

[0094] Especially an axial rotation mold motor manufactures a sleeve by one in housing, and by the axial cover-half motor, since squareness improves, structural rigidity and endurance not only increase, but [ in order to manufacture a sleeve by one to a hub, ] it it not only can decrease RRO of a motor, but has the advantage which can decrease **** by structure vibration.

[0095] Moreover, it not only becomes easy like an erector, but [ in order to manufacture a thrust by the shaft and one ] since the coaxiality of a shaft improves greatly, there is an advantage which makes the property of vibration of a motor, NRRO which affects ****, and RRO improve.

[0096] Therefore, since structural rigidity and endurance can increase and this invention can make the property of NRRO of a motor, and RRO it not only can to increase the assembly-operation nature, workability, and productivity in a manufacture process, but improve, it does so the very useful effectiveness which can raise the dependability over extension and the engine performance of a use life.

[0097]

[Effect of the Invention] As explained in full detail, since structural rigidity and endurance can increase and this invention can make the property of NRRO of a motor, and RRO it not only can to increase the assembly-operation nature, workability, and productivity in a manufacture process, but improve, it does so very useful effectiveness [ say / that the dependability over extension and the

engine performance of a use life can be raised ].

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view having shown the axial rotation mold fluid dynamic pressure bearing motor concerning the conventional technique.

[Drawing 2] It is the decomposition perspective view of the important section in drawing 1 .

[Drawing 3] It is the sectional view having shown the axial cover-half fluid dynamic pressure bearing motor concerning the conventional technique.

[Drawing 4] It is the important section decomposition perspective view of drawing 3 .

[Drawing 5] It is the graph which measured the roundness of the fluid dynamic pressure bearing motor of drawing 1 .

[Drawing 6] It is the graph which measured the straightness of the fluid dynamic pressure bearing motor of drawing 1 .

[Drawing 7] It is the sectional view having shown the axial rotation mold fluid dynamic pressure bearing motor concerning this invention.

[Drawing 8] It is the important section decomposition perspective view of drawing 7 .

[Drawing 9] It is the sectional view having shown the axial cover-half fluid dynamic pressure bearing motor concerning this invention.

[Drawing 10] It is the important section decomposition perspective view of drawing 9 .

[Drawing 11] It is the graph which measured the roundness of the fluid dynamic

pressure bearing motor of drawing 7 .

[Drawing 12] It is the graph which measured the straightness of the fluid dynamic pressure bearing motor of drawing 7 .

[Drawing 13] It is the graph which compared the load-carrying capacity of the fluid dynamic pressure bearing motor concerning this invention and the conventional technique, rigidity, and damping.

[Drawing 14] It is the graph which compared the load-carrying capacity of the fluid dynamic pressure bearing motor concerning this invention and the conventional technique, rigidity, and damping.

[Drawing 15] It is the graph which compared the rigidity concerning this invention and the conventional technique.

[Drawing 16] It is the graph which compared the rigidity concerning this invention and the conventional technique.

[Drawing 17] It is the graph which compared damping concerning this invention and the conventional technique.

[Drawing 18] It is the graph which compared damping concerning this invention and the conventional technique.

[Description of Notations]

10 Housing

15 Magnet

16 Cover Plate

20 Sleeve

21 Boss

22 Slot for Dynamic Pressure Generating

30 Hub

40 Core

50 Shaft

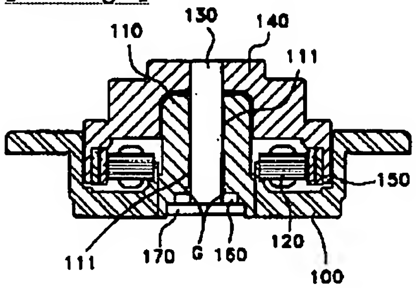
51 Slot for Dynamic Pressure Generating

55 Thrust

G Oil gap

DRAWINGS

[Drawing 1]

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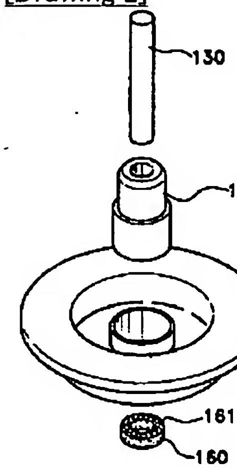


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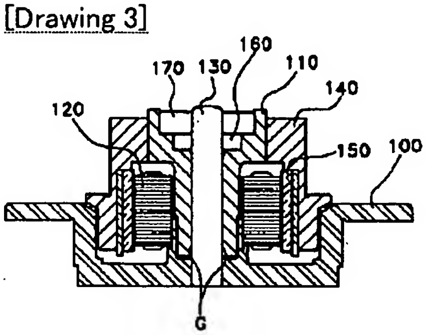


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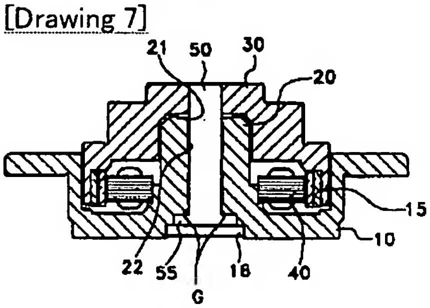


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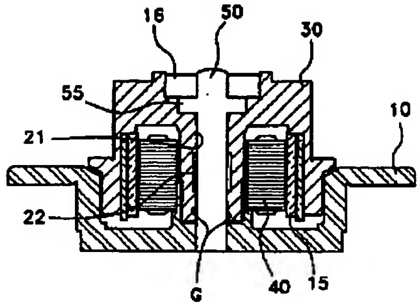


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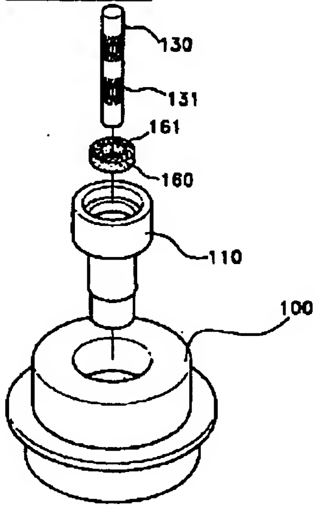


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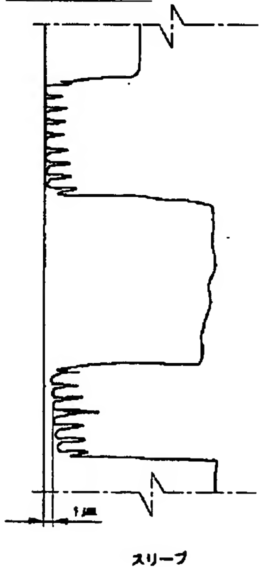


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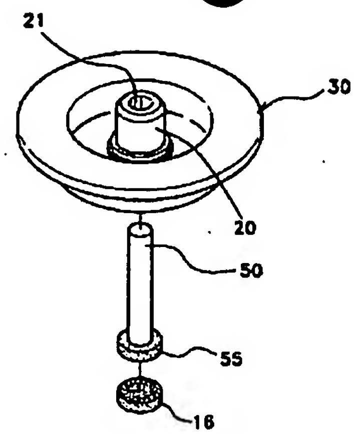


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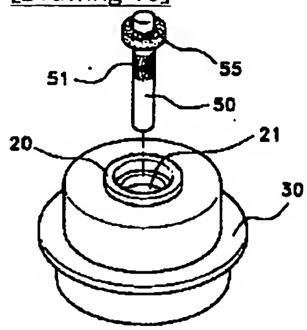


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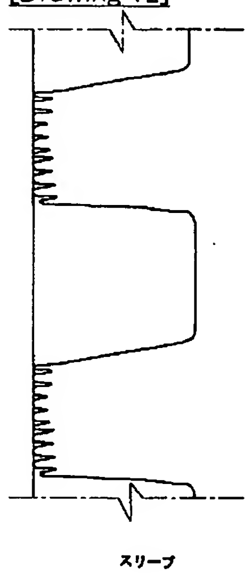
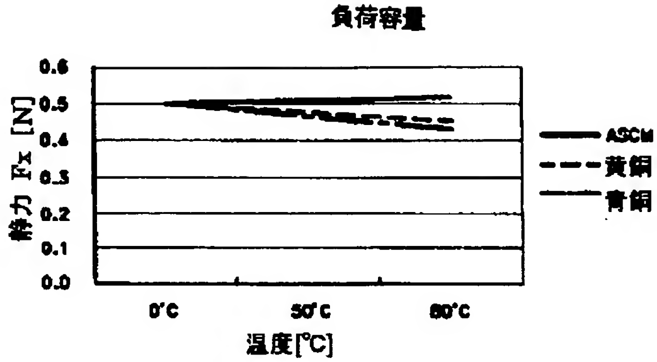



[Drawing 13]

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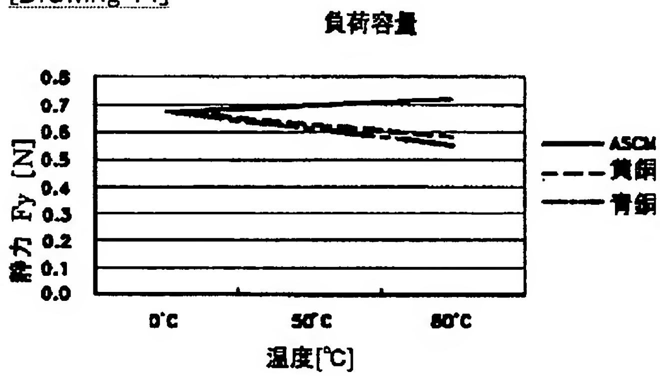


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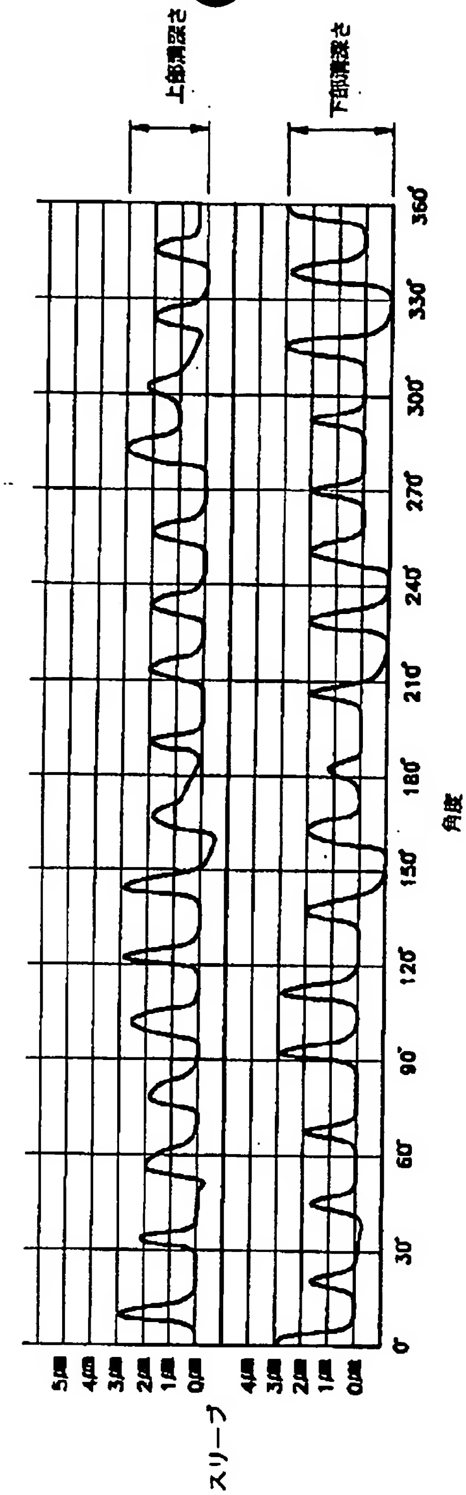
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120°
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3μm
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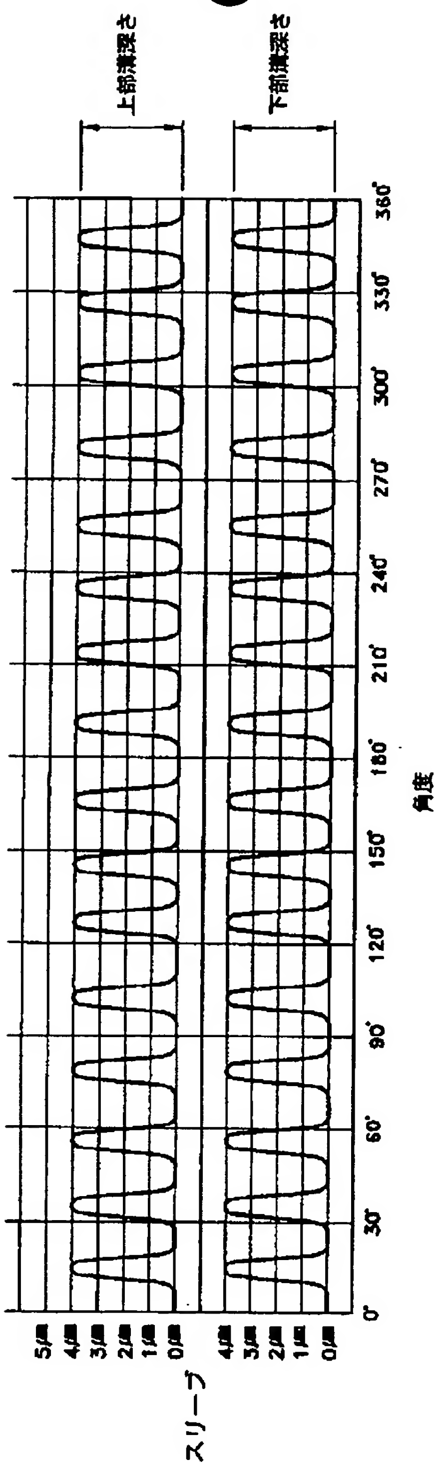
1μm
0μm

[Drawing 11]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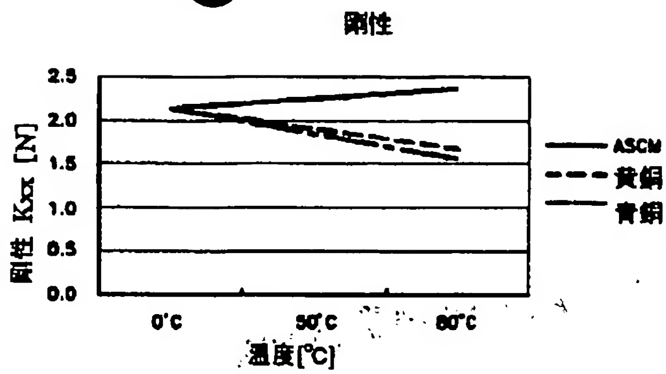
[Drawing 15]

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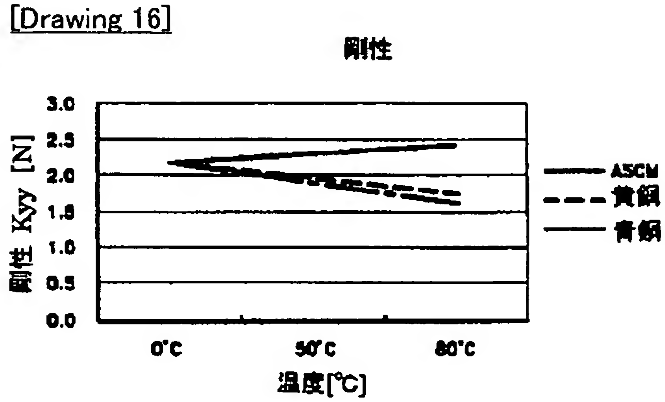


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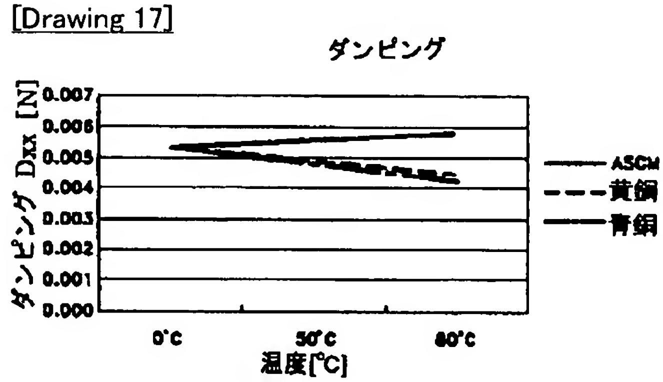


[Drawing 18]